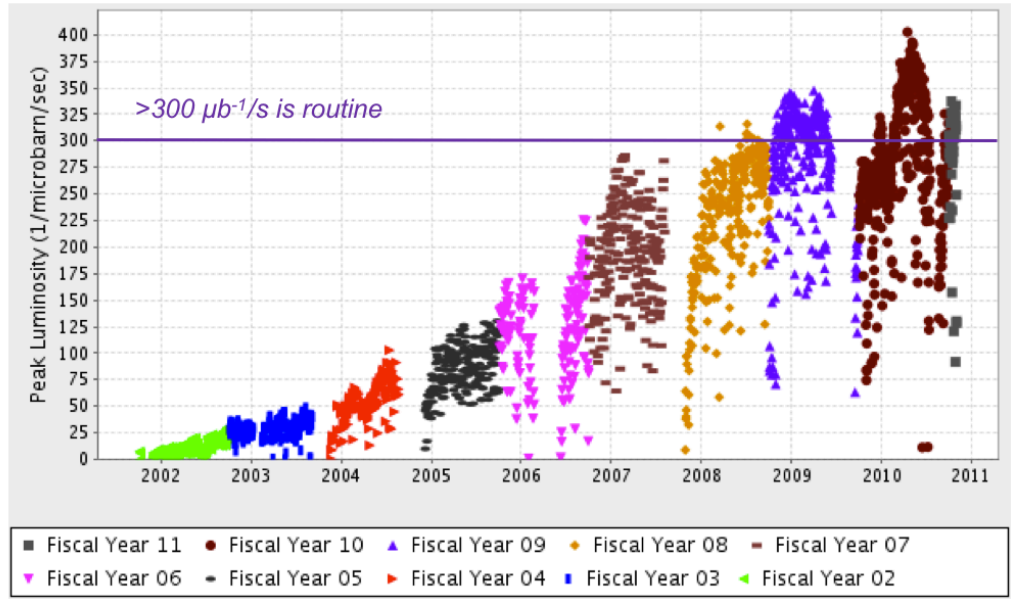
Tevatron Operations and Physics

Michael Kirby
Fermilab - CD

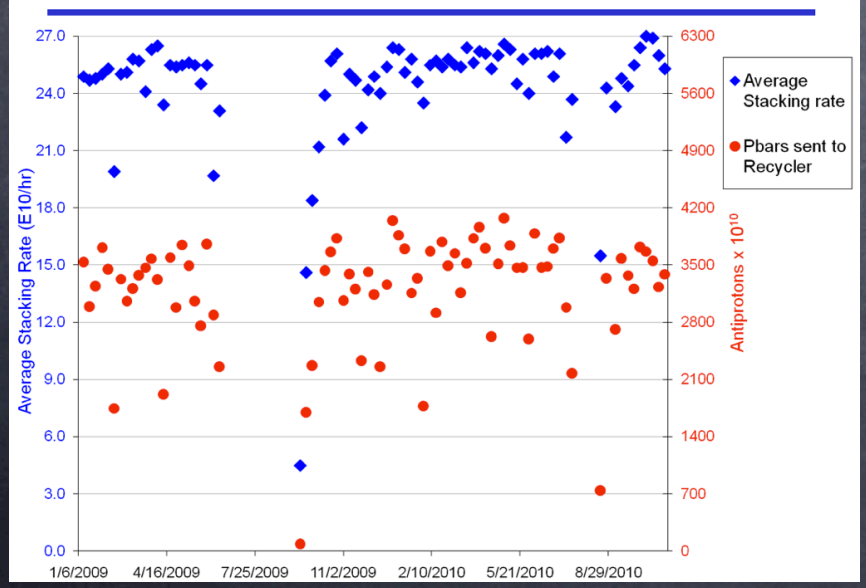
Tevatron Performance

- shutdown activities
  - Warmed up two houses
  - A3 and D4 fix cryo leaks
  - no magnet replacements
- Pelletron trips - recycler

Run 2 Peak Luminosities

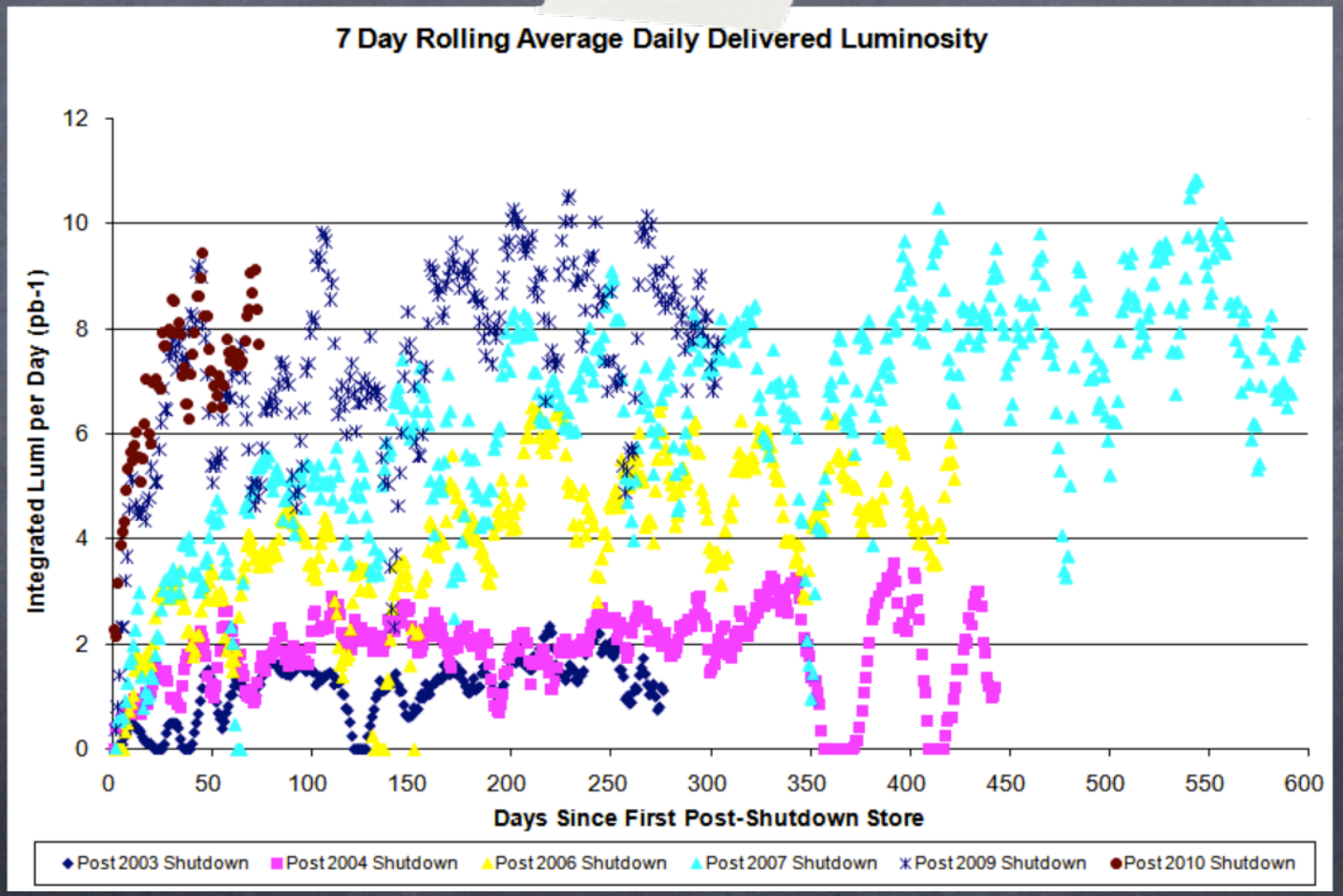


Pbar Performance



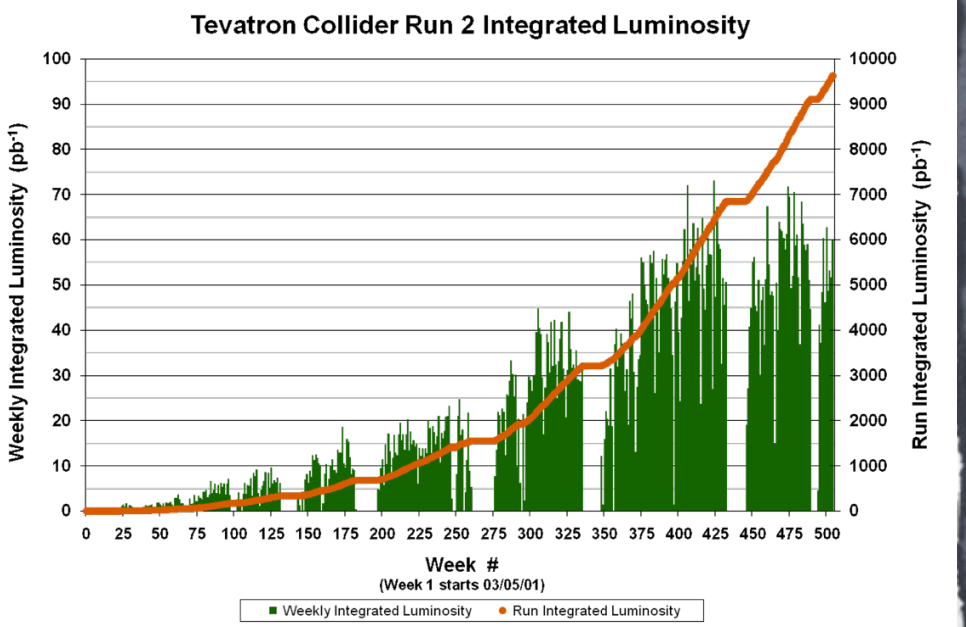
- smooth startup from shutdown
  - ~120 store hrs/wk
  - initial lumi averaging ~ 300e30
  - Sep & Oct > 200 pb^{-1}
- stacking rates similar to before shutdown
  - 28e10/hr average

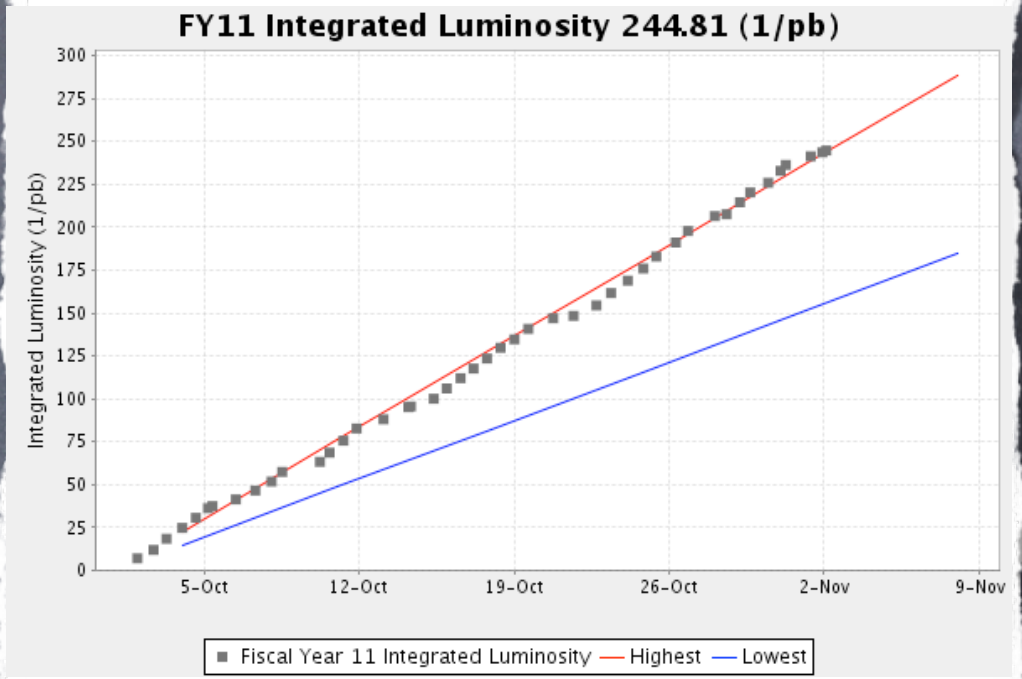
Tevatron Performance



Best RunII recovery by Tev from a shutdown

Tevatron Integrated Luminosity



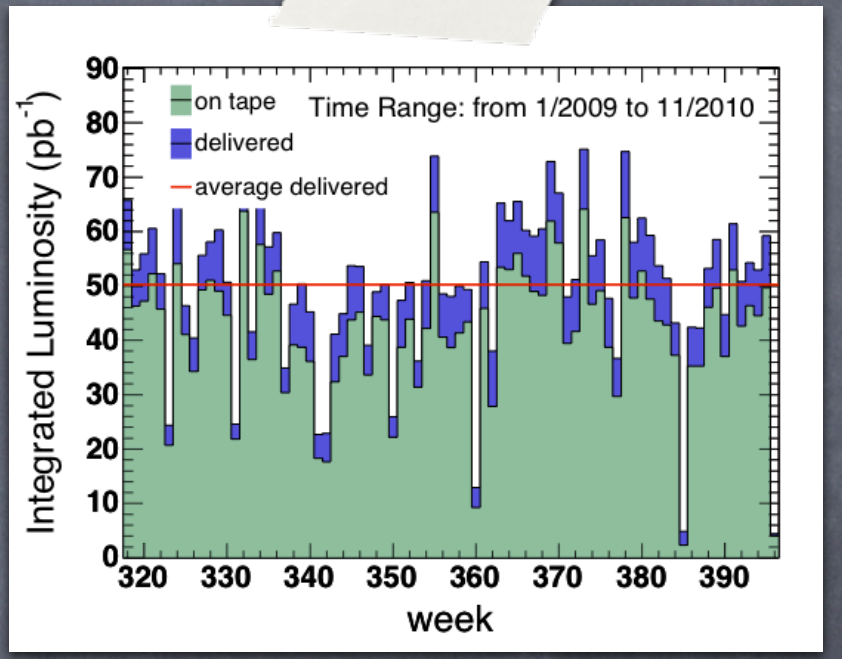


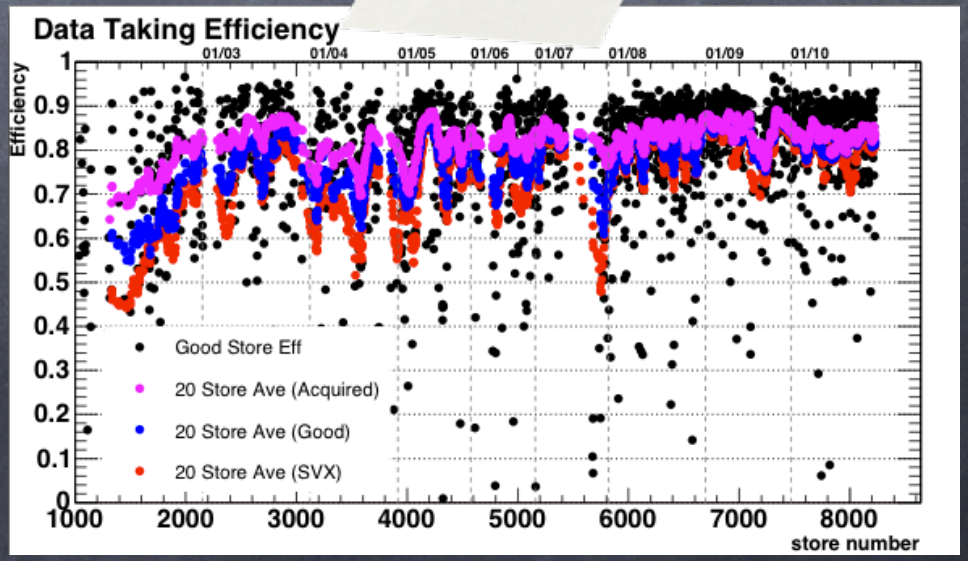
- FY10 delivered 2.47 fb^{-1}
- Highest ever delivered

- so far FY11 244 pb^{-1}
- without shutdown project FY11 > 2.7 fb^{-1}

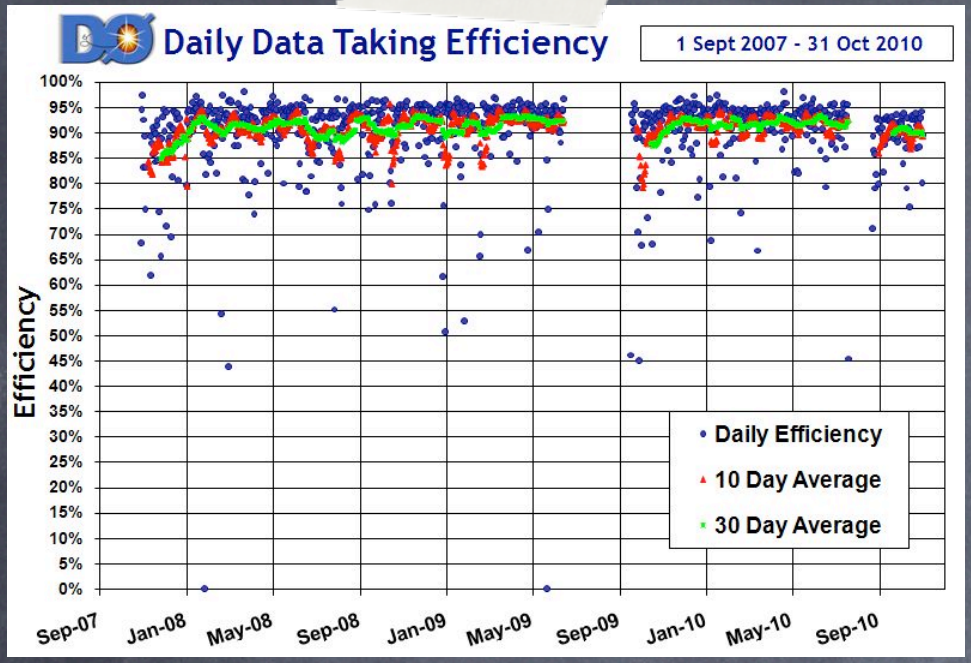
Detector Status at CDF

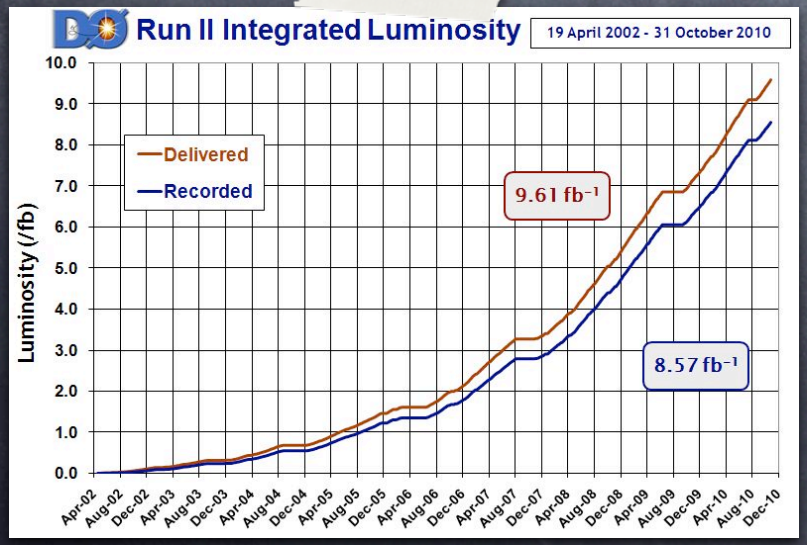
- shutdown activity
  - Drift Chamber LV fix
  - SVX readout light yield baseline
  - regular maintenance
- Very smooth operations following shutdown
- data taking eff 85%
- > 8 fb^{-1} recorded
  - > 2 fb^{-1} in FY10





Detector Status at D0

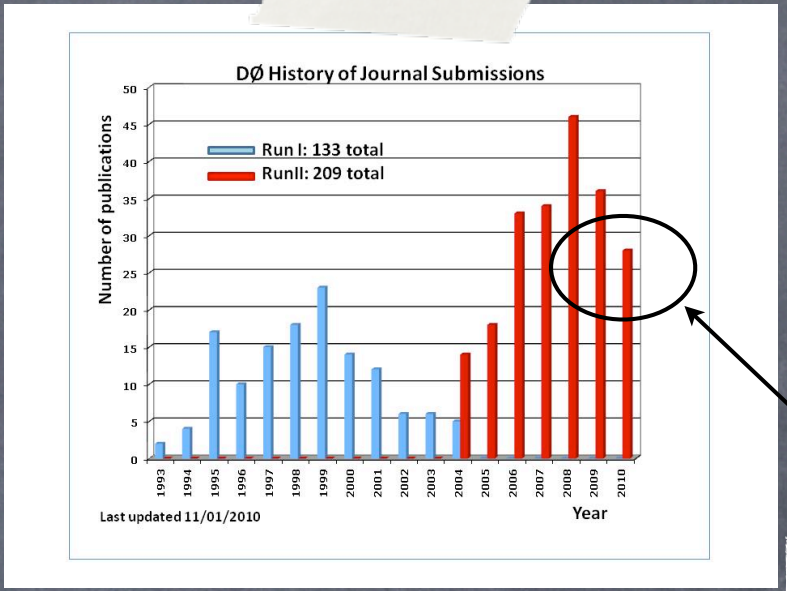




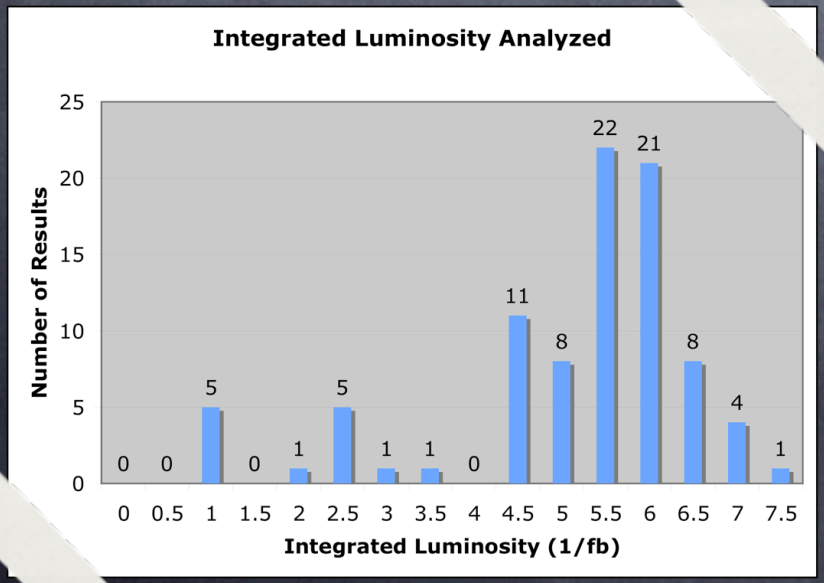
- shutdown activities
  - luminosity monitor maintenance
  - Cal, Muon, SMT channel recovery
  - Fiber Tracker firmware readout upgrade
- data taking eff >90%
- > 8.5 fb^{-1} recorded

Tevatron Paper Mill

- impressive number of results and publications at CDF & D0
  - > 100 results in 2010
- excellent utilization of large datasets and computing
- leading the way across wide range of physics topics



so far 28 each



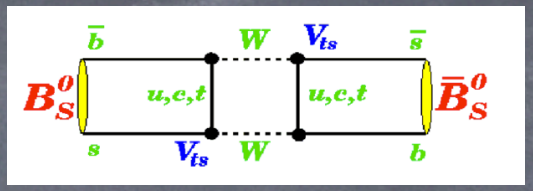
> 100 Tevatron Results in 2010

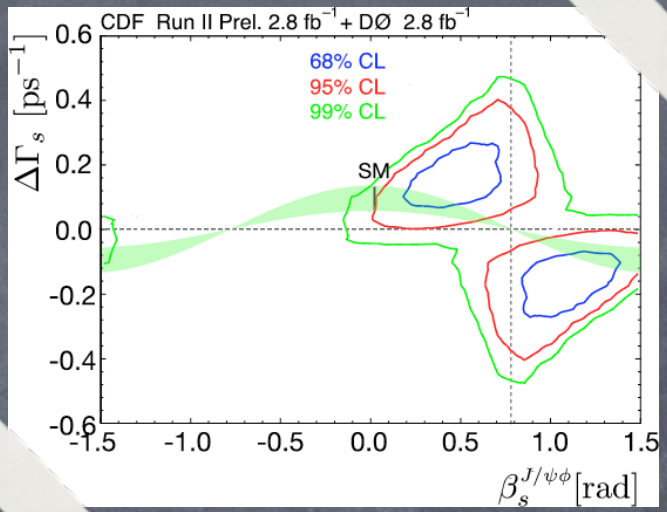
for (i=0,i<100,i++) printf("%s\n","I will not chew gum in class.");

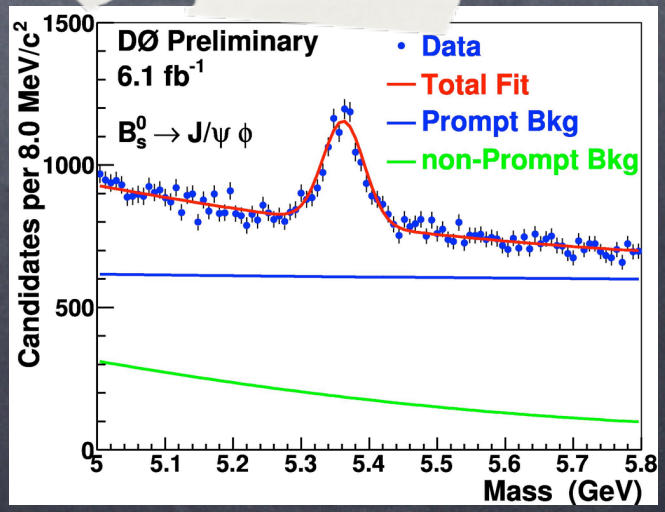
B Physics

CP-violating phase ϕ_s

- $B_S \rightarrow J/\psi$ ($J/\psi \rightarrow \mu^+\mu^-$, $\phi \rightarrow K^+K^-$)
- previous CDF & D0 combination showed 2.1σ deviation from SM
- Both experiments almost double dataset
  - CDF 5.2 fb^{-1} - D0 6.1 fb^{-1}
- improved initial state tagging at both CDF and D0
- CDF 0.8σ - D0 1.1σ







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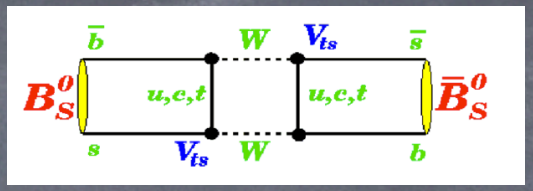
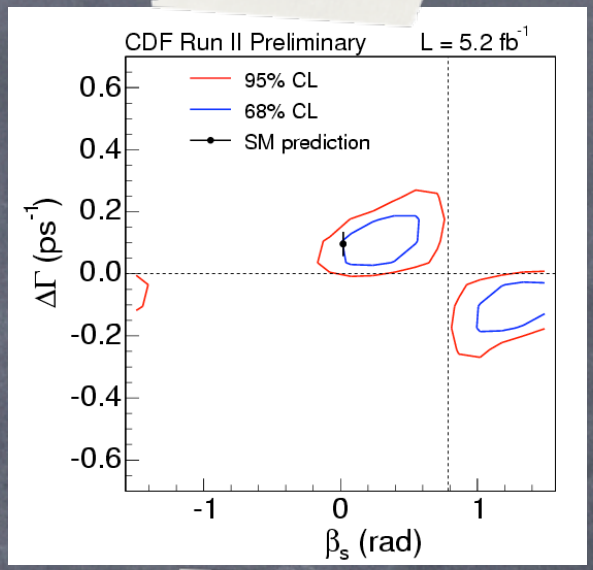
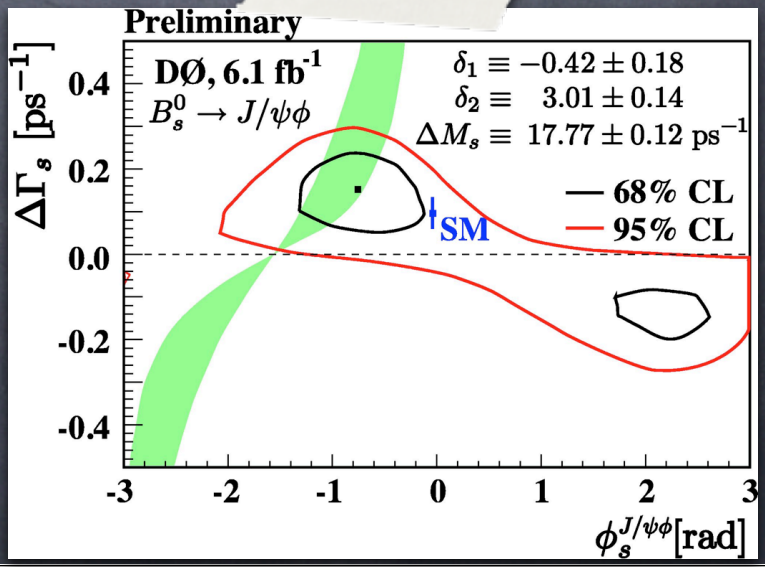
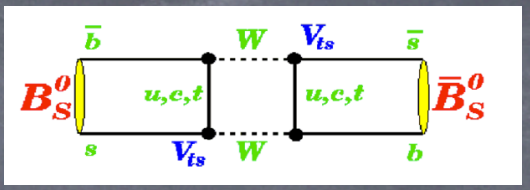






B Physics

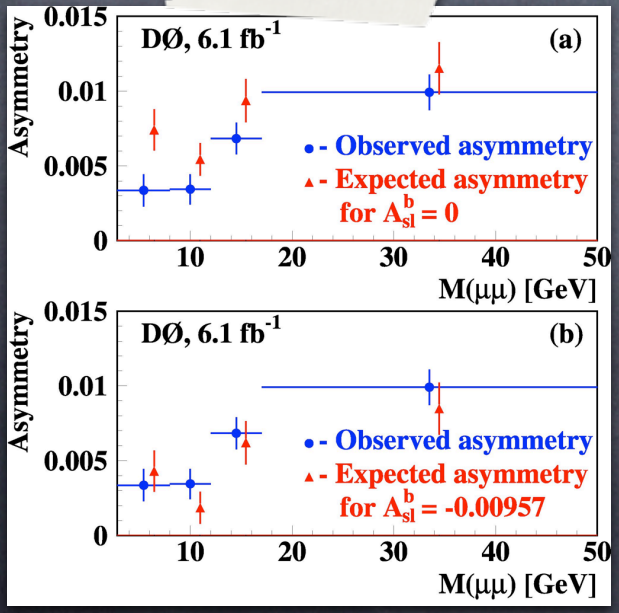
like-sign dimuon charge asymmetry

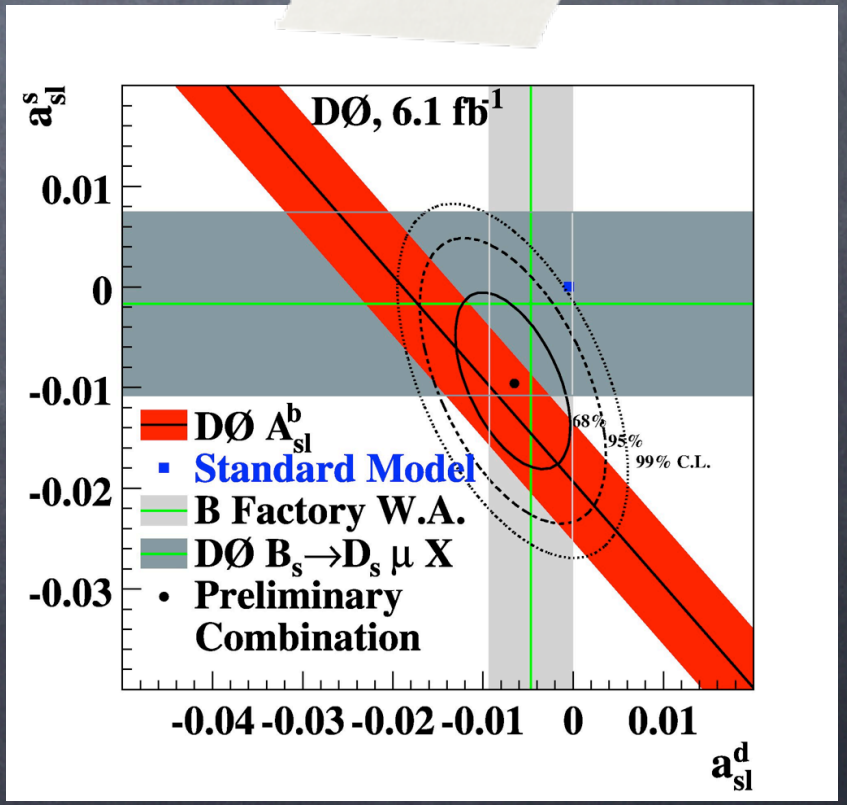


- account for muon charge asymmetry
- correct for K,π,p background
- A^b_{sl} = -0.00957 ± 0.00251 (stat) ± 0.00146 (syst)
- $A^b_{sl}(SM) = -2.3(\pm 0.6)\times 10^{-4}$

$$a^b_{sl} = \frac{\Delta\Gamma_b}{\Delta M_b}\tan\phi_b$$

$$A \equiv \frac{N^{++} - N^{--}}{N^{++} + N^{--}}$$

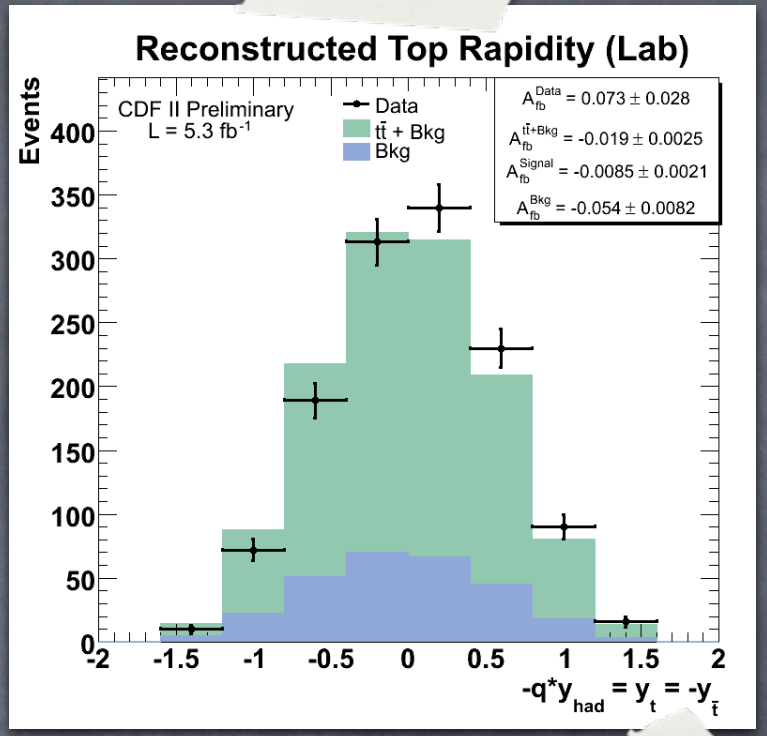


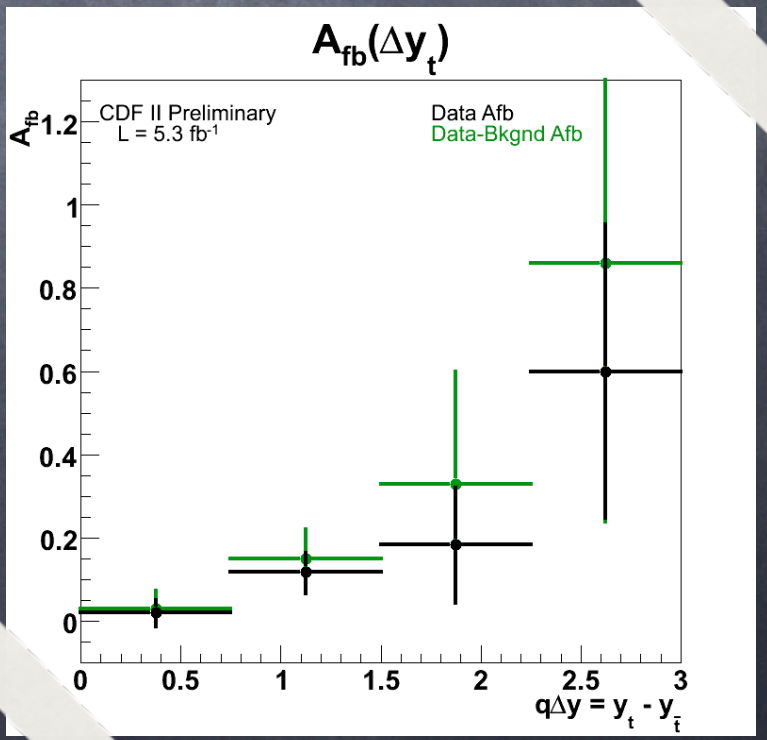


Top Physics

top charge asymmetry

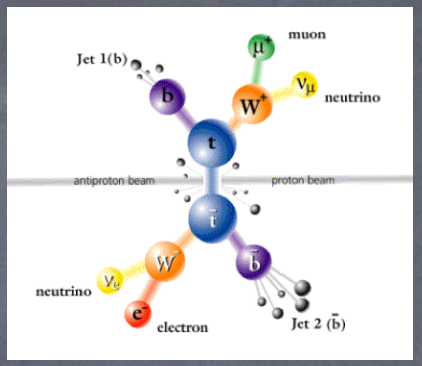
- top production at LO is symmetric, NLO predicts slight asymmetry
  - $A_{fb}(SM) = 0.038$
- new physics can produce larger A_{fb}
- $A_{fb} = 0.150 \pm 0.050$ (stat) ± 0.024 (syst)
- measurement incorporates dependence of rapidity difference





Top Physics

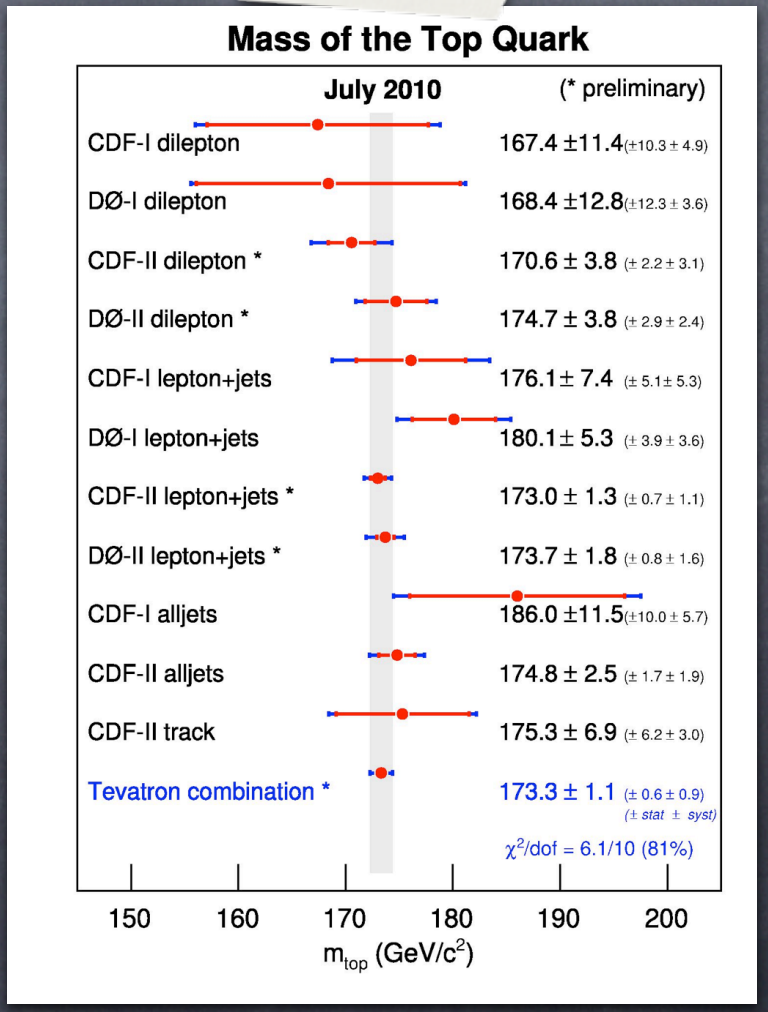
top mass measurement



- Using up to 5.6 fb^{-1}
- most precise single measurement ±1.3 GeV
- July 2010 combined CDF & DO result

m_{top} = 173.3 ±1.1 GeV

- error less than 0.6%
- with 8 fb^{-1} < 1 GeV



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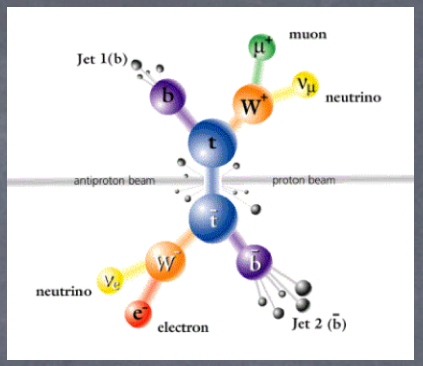

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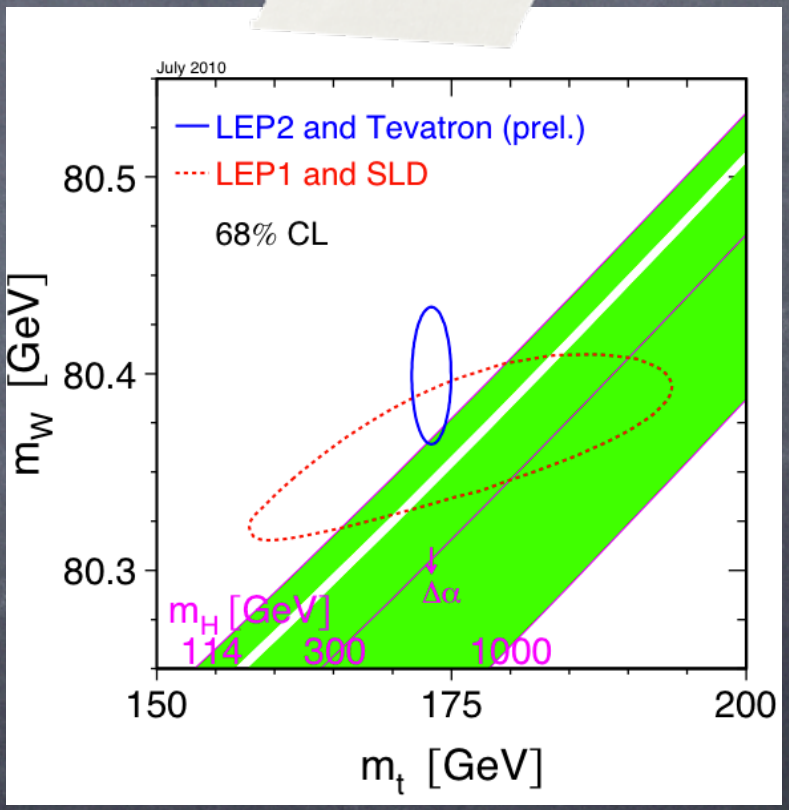
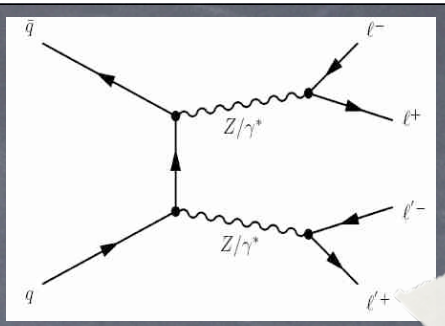
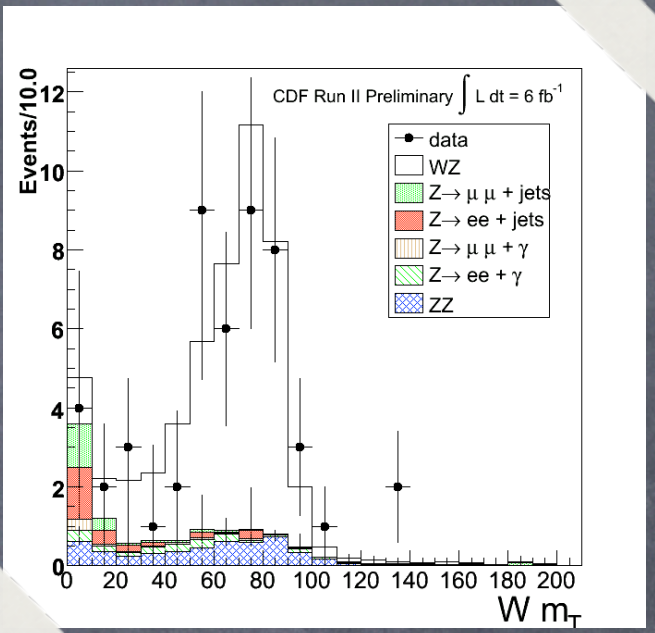


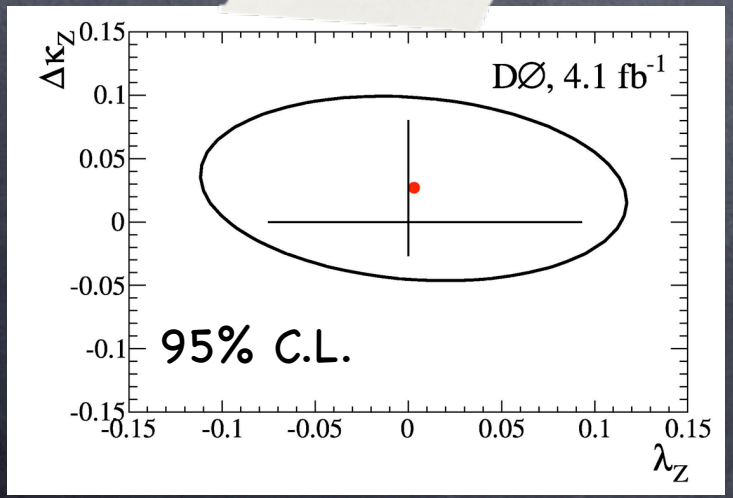
EWK Physics

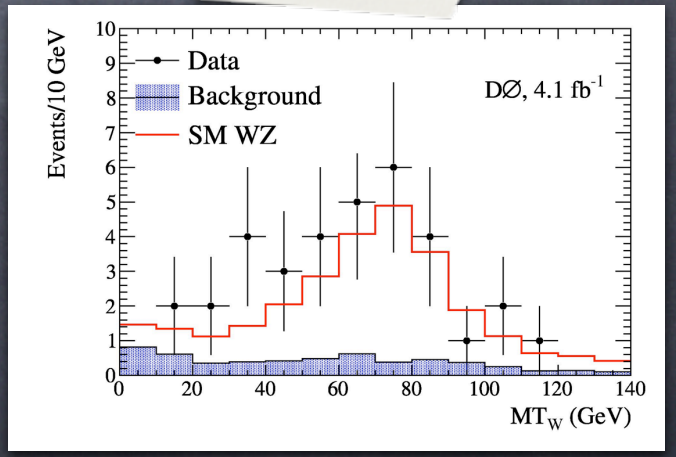
diboson production

- measure WZ & ZZ cross sections
- important tests of higher order calculations
- pushing limits of acceptance and analysis techniques
- worlds best limits on anomalous coupling κ_Z





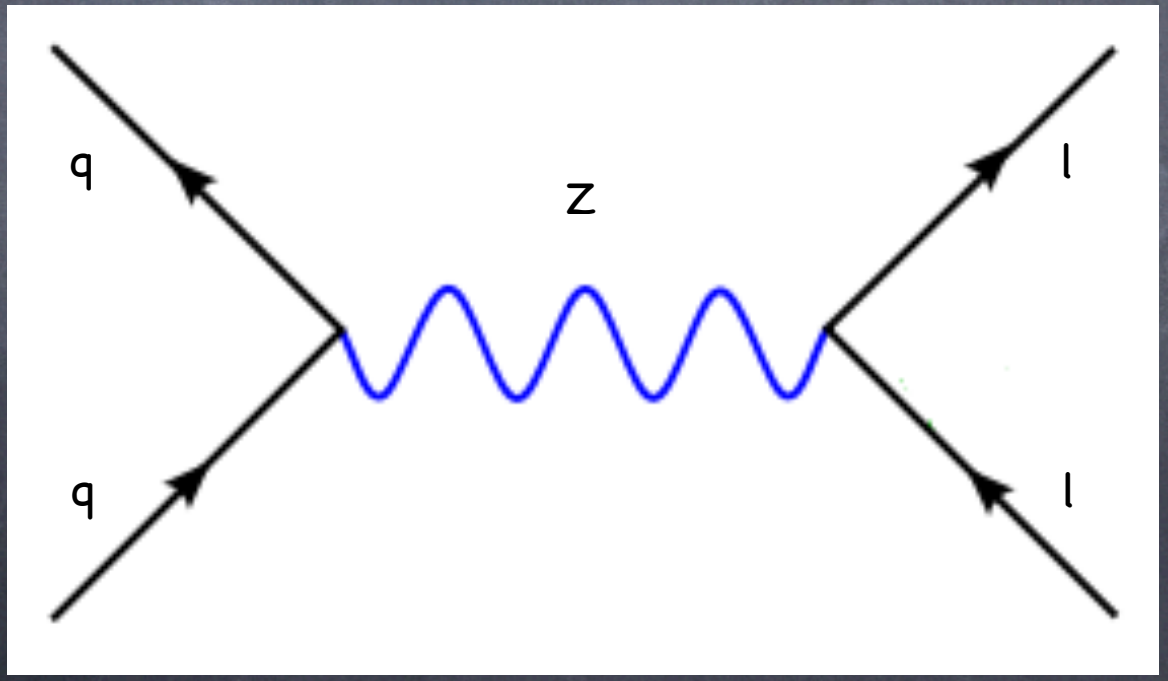




EWK Physics

Z-p_T measurement

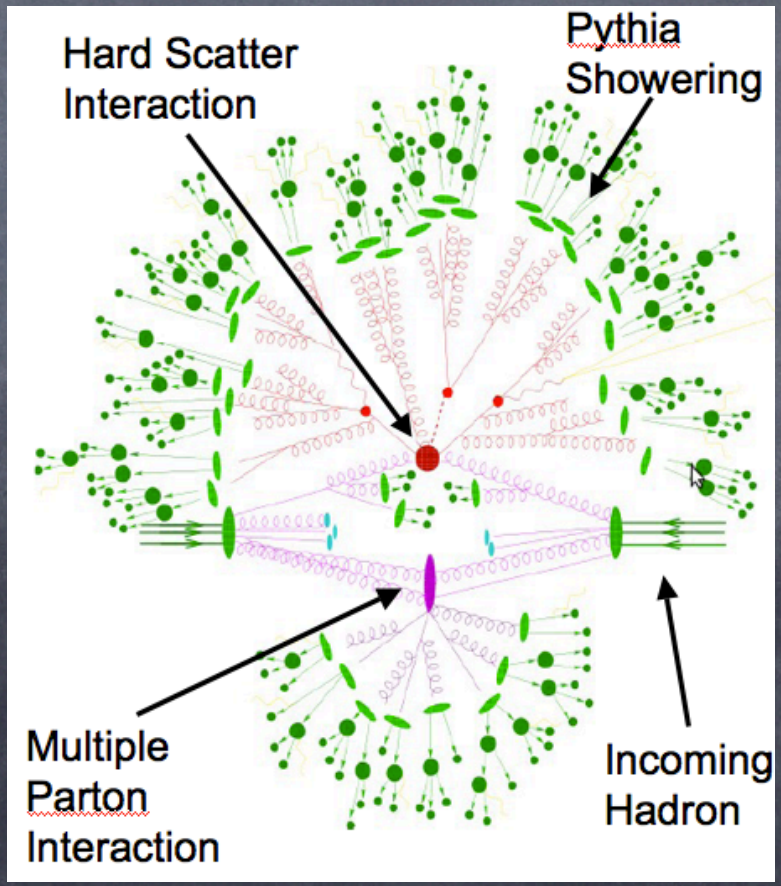
Ideally



EWK Physics

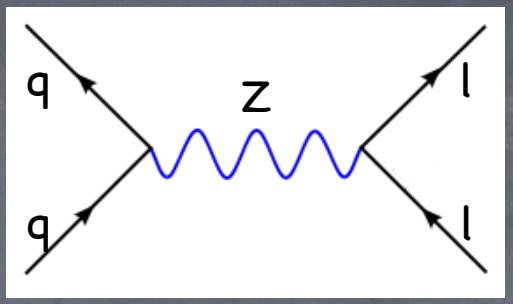
Z-p_T measurement

Closer to Reality

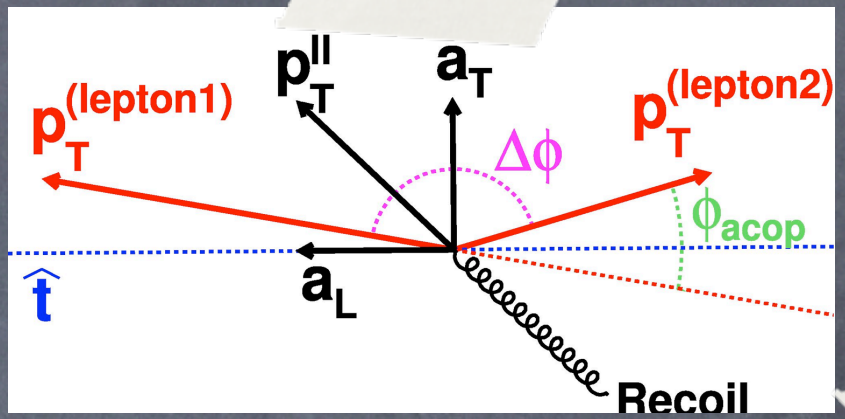


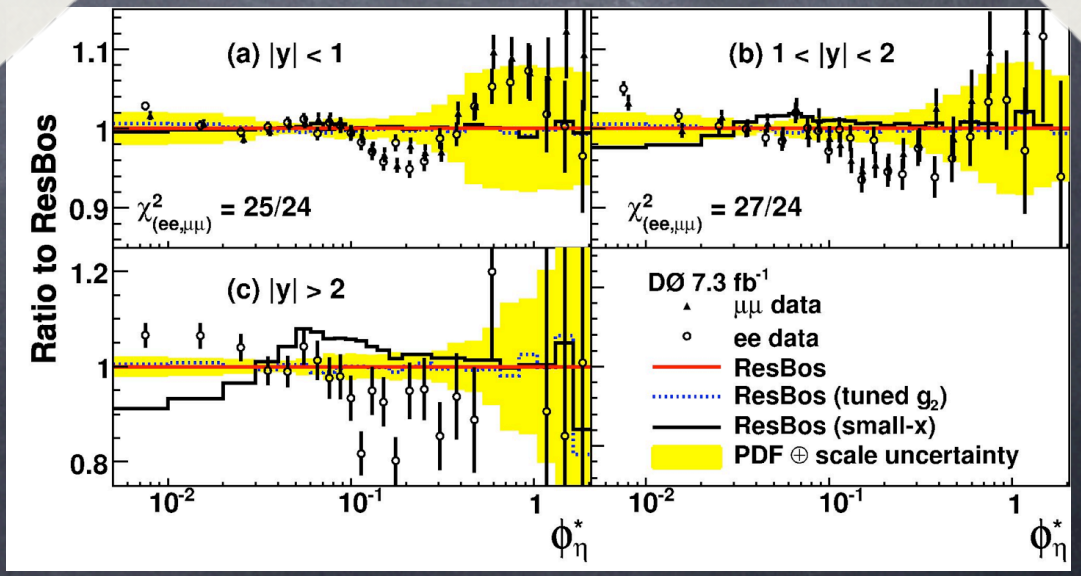
EWK Physics

Z-p_T measurement



- New novel technique
- minimize effect of resolution and efficiency
- measure ϕ^*_η which shows same effect as Z-p_T
- using 7.3 fb^{-1} D0 data
- important constraint on small-x broadening

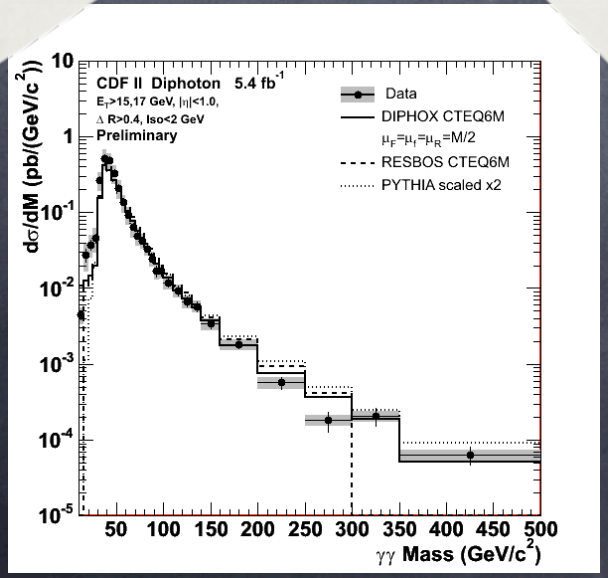


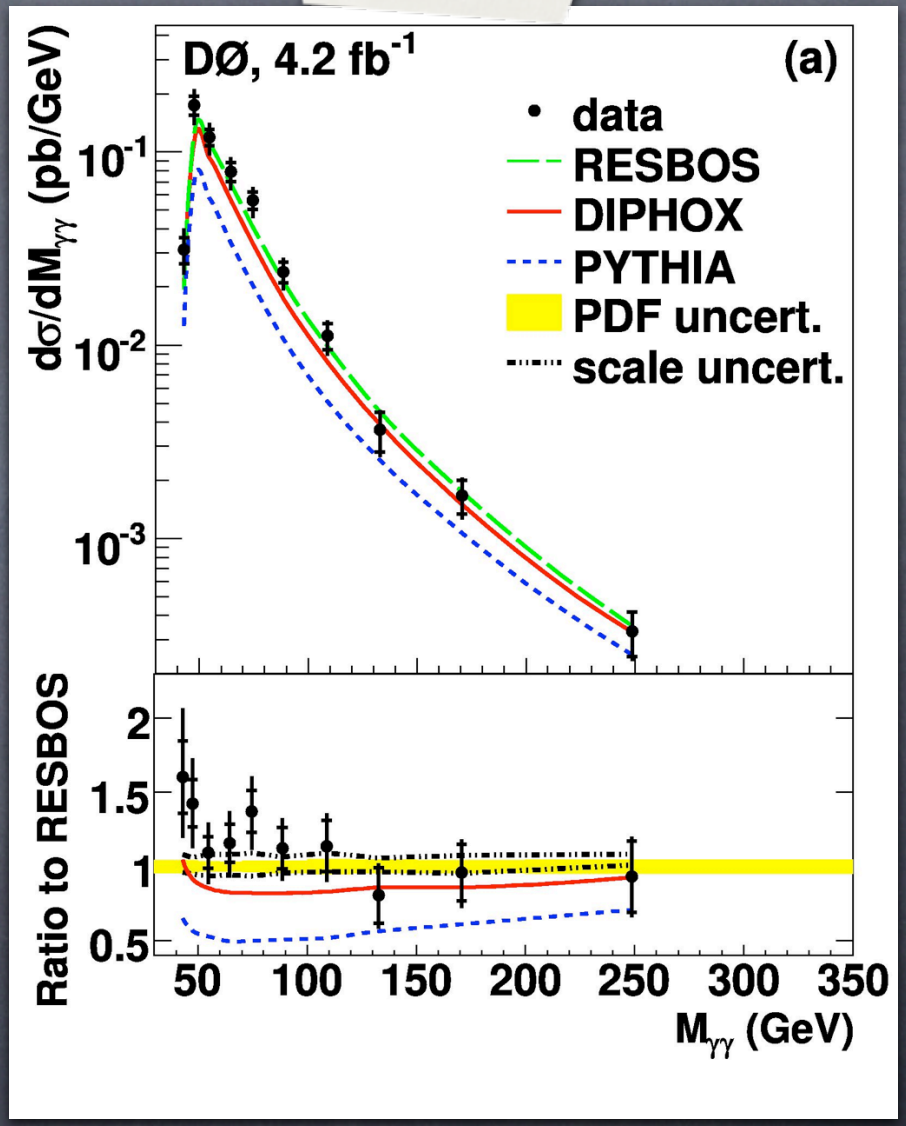


QCD Physics

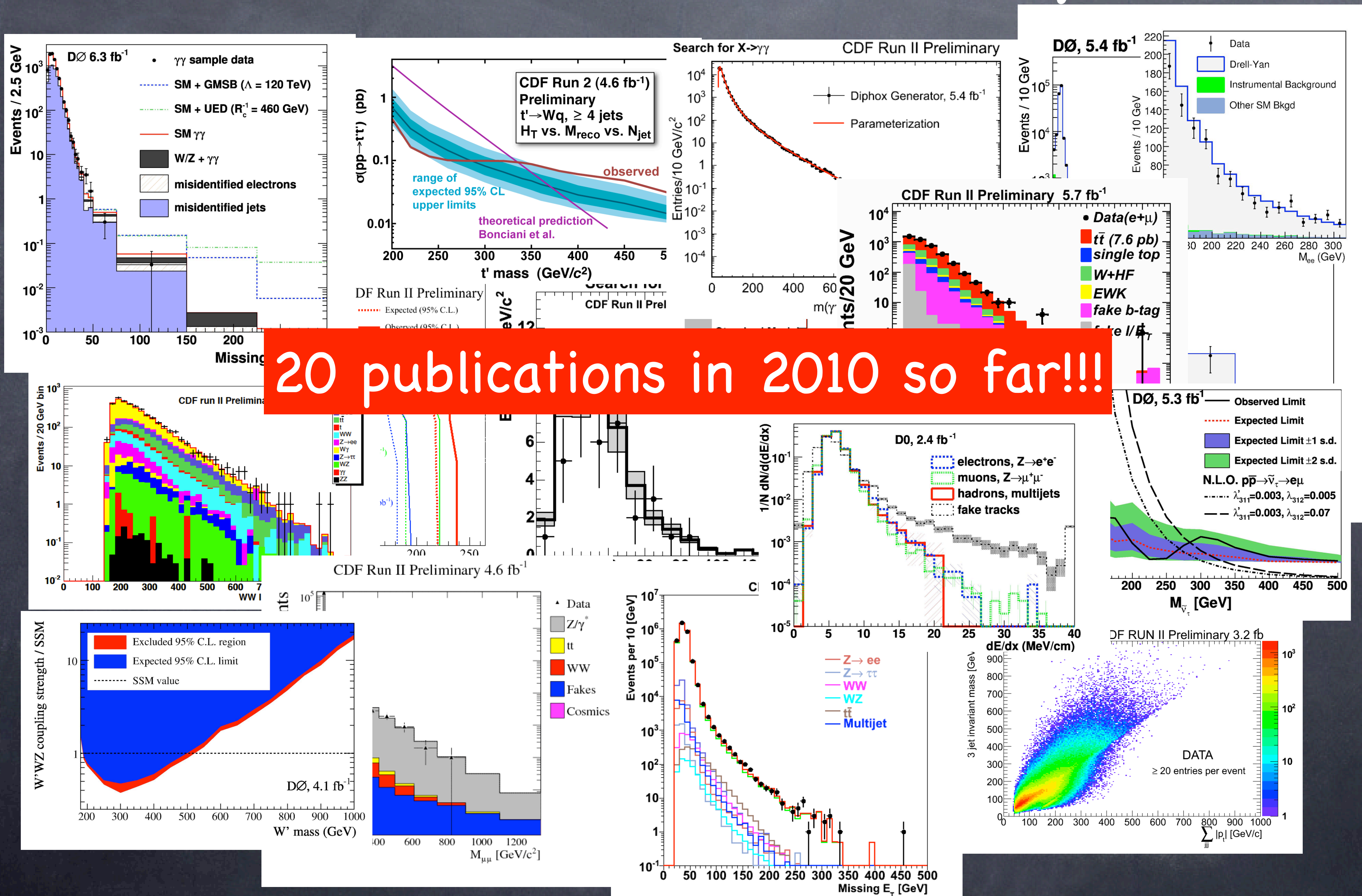
diphoton σ measurement

- both CDF & D0 measure $\sigma(M_{\gamma\gamma})$
- Comparison with several LO, NLO, and resummed calculations show limitations of modeling
- important for $H \rightarrow \gamma\gamma$ searches





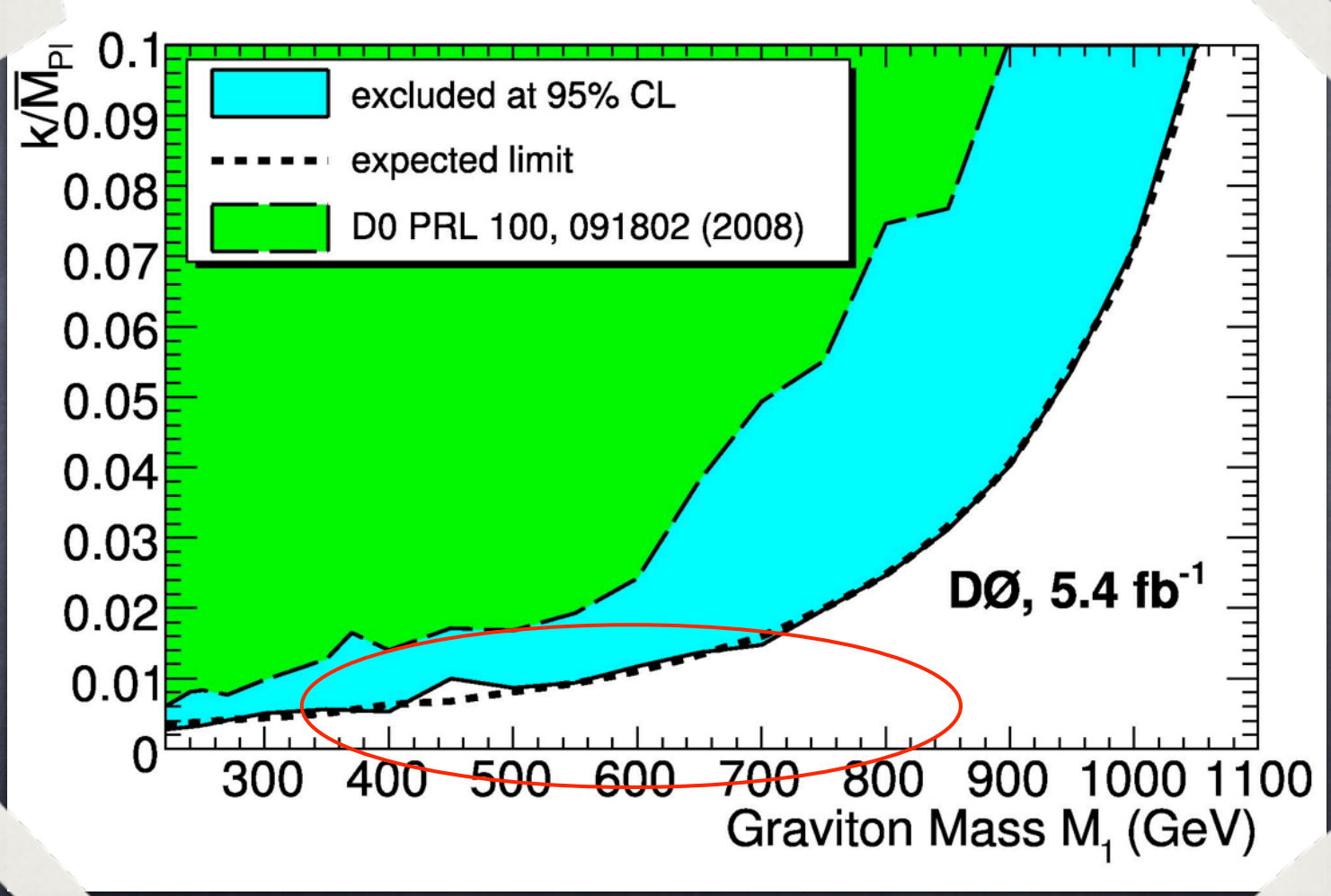
Searches for New Physics



20 publications in 2010 so far!!!

Searches for New Physics

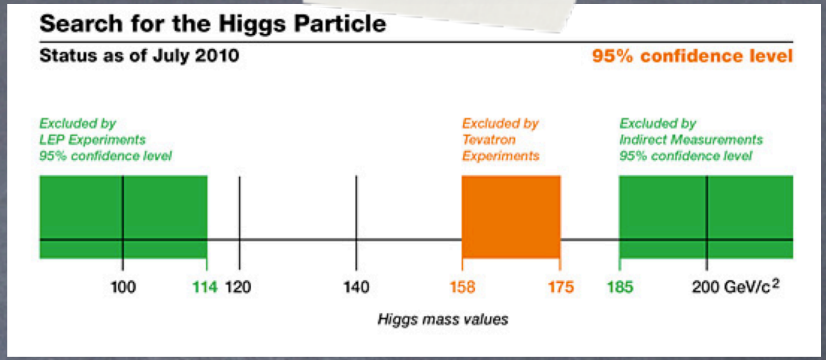
Gauge Mediated SUSY Breaking

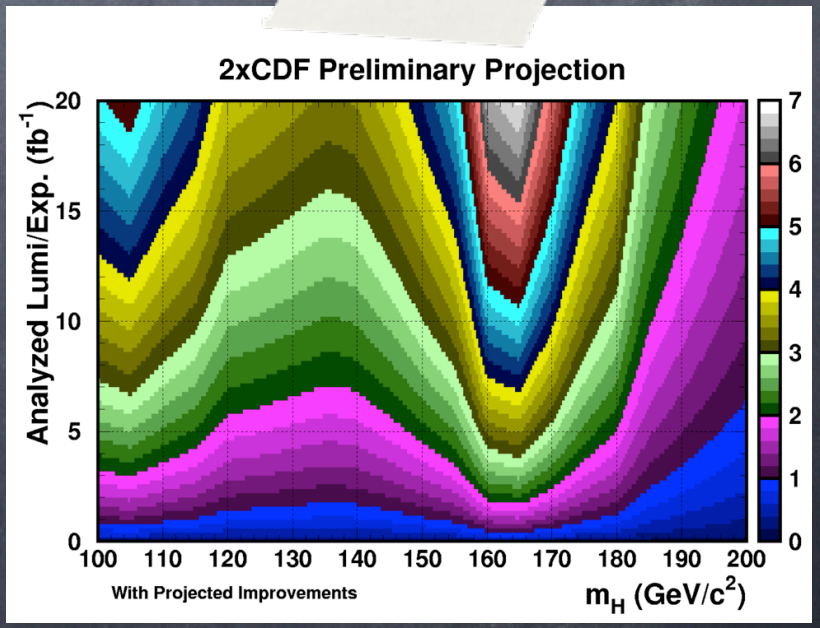


At low coupling strength, luminosity more significant than center of mass energy

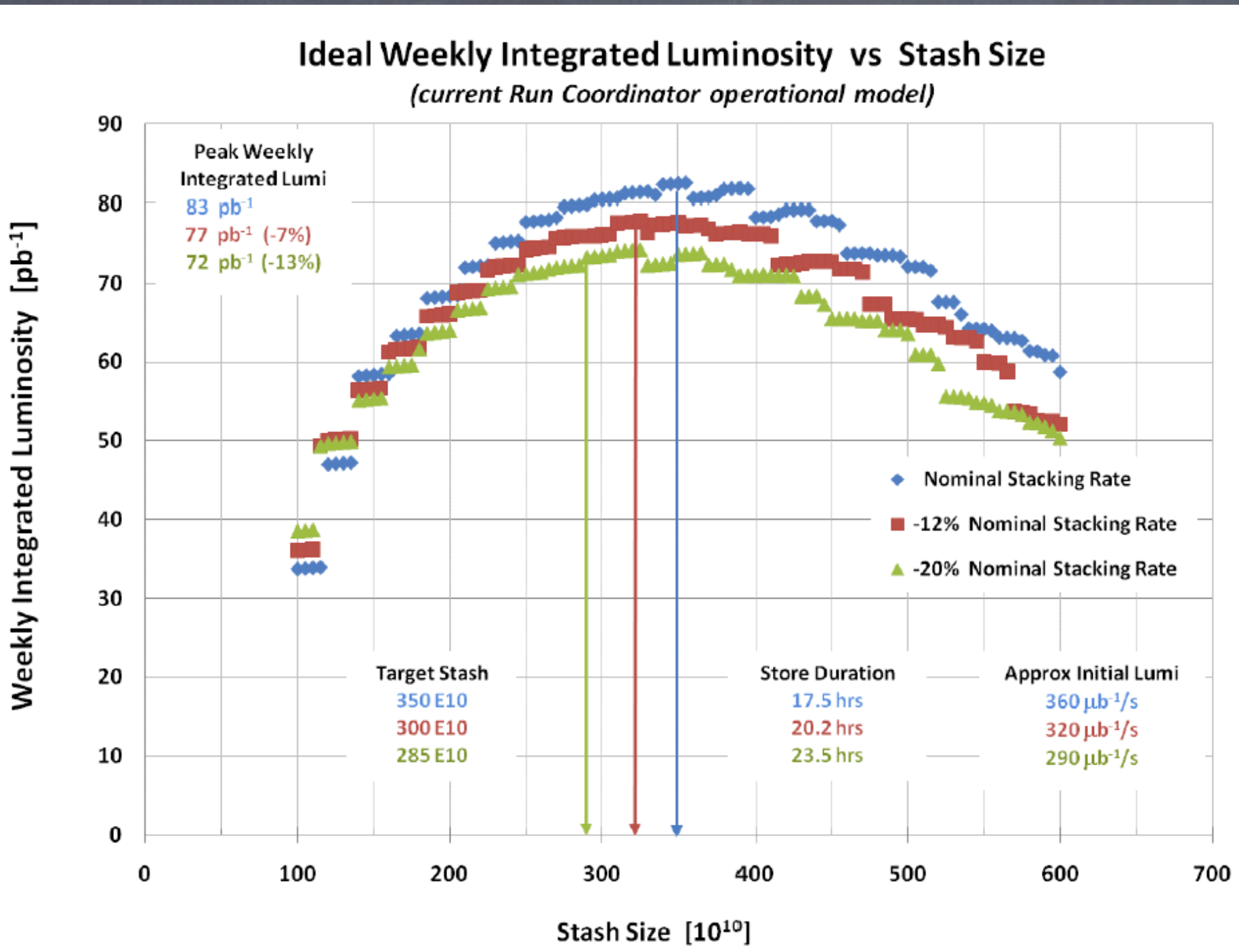
Tevatron Program Summary

- Tevatron is performing excellently, best startup from shutdown ever
- CDF and D0 running stably and with high efficiency
- Broad program of physics topics
- CDF & D0 very active in producing results and publications
- Expect more great results from Tevatron, CDF, and D0
- Excited about the prospects for recording and analyzing 16 fb^{-1}
- Would like to thank the PAC for strong endorsement of RunII extension.





Backup


Ideal Weekly Integrated Luminosity vs Stash Size
(current Run Coordinator operational model)
Weekly Integrated Luminosity [pb-1]
Stash Size [10^10]
Peak Weekly Integrated Lumi
83 pb-1
77 pb-1 (-7%)
72 pb-1 (-13%)
Nominal Stacking Rate
-12% Nominal Stacking Rate
-20% Nominal Stacking Rate
Target Stash
350 E10
300 E10
285 E10
Store Duration
17.5 hrs
20.2 hrs
23.5 hrs
Approx Initial Lumi
360 µb-1/s
320 µb-1/s
290 µb-1/s
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
700